40-7102

State of New Jersey
Department of Environmental Protection and Energy
Division of Responsible Party Site Remediation
CN 028
Trenton, NJ 08625-0028

Scott A. Weiner
Commissioner

Karl J. Delaney
Director

Gary Comfort
Project Manager
Fuel Cycle Safety Branch
Mailstop 6H3
USNRC
Washington, D.C. 20555

MAR 04 1993

Re: Shieldalloy Metallurgical Corporation

Dear Mr. Comfort:

Attached please find for your information copies of Thomas McGinty's Site Investigation Report and Nancy Stanley's Site Visit Memo for the site visit to Shieldalloy Metallurgical Corporation (SMC) on February 17-18, 1993.

If you have any questions or comments, please do not hesitate to contact me at (609) 633-1455.

Sincerely,

Donna L. Gaffigan

Donna L. Gaffigan, Case Manager
Bureau of Federal Case Management

Attachments

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NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY
DIVISION OF RESPONSIBLE PARTY SITE REMEDIATION

INSPECTION REPORT

INSPECTOR: Thomas S. McGinty
CASE NAME: Shieldalloy
ADDRESS: N.W. Blvd. Newfield
COUNTY: Gloucster
LOCATION TELEPHONE: (609) 692-4200
EPA ID#: NJD002365930

DATE: 2/17/1993
ARRIVAL: 2130
DEPARTURE: 0345
WEATHER: cold, clear
TEMP: ± 35° F
PAC: EJG

CASE TEAM MEMBERS

CASE MANAGER: Donna Gaffigan	NJDEPE-BFCM	(609) 633-1455
GEOLOGIST: George Nicholas	NJDEPE-BGWPA	(609) 292-8427
TECH. COORD: John Boyer	NJDEPE-BEERA	(609) 984-3068
RADIATION: Nancy Stanley	NJDEPE-BER	(609) 987-2101

REPRESENTATIVES PRESENT

NAME:	REPRESENTING:	TITLE:	PHONE:
Thomas McGinty	NJDEPE-BFCM	Inspector	(609) 633-1455
Donna Gaffigan	NJDEPE-BFCM	Case Manager	(609) 633-1455
Craig Rieman	SMC	Environmental Mgr.	(609) 692-4200
Knud Klausen	SMC	Process Engineer	(609) 692-4200
David Smith	SMC	Dir. Env. Services	(609) 692-4200
Yamar Faraz	USNRC	Project Manager	(301) 504-2669
Gary Comfort	USNRC	Project Manager	(301) 504-2667
Michael Tokar	USNRC	Supervisor	(301) 504-2590
Rosie Mazeka	Battelle PNL	Contractor	
Betsy Ullrich	USNRC	Regional Inspector	(215) 337-5000
Tracy Eikenberry	Battelle PNL	Contractor	

BACKGROUND: Shieldalloy Metallurgical Corporation (SMC) is the manufacturer of various metallic alloys, which are used both as products or as additives to metal products to improve or impart various physical characteristics to steel, aluminum, etc. They also manufacture alloys of various precious metals in limited amounts. Titanium, platinum, lead, chromium, and vanadium products have been or are produced at the site. SMC provides many of these special alloys under government and military contracts.

OBJECTIVE: The objective of the inspection is to observe the smelting of standard grade ferro-columbium (Niobium) alloy from a raw material or ore known as pyrochlore. Pyrochlore is a pale yellow, reddish, brown or black isometric mineral whose composition is: $(Na,Ca)_2(Nb,Ta)_2O_6(OH,F)$. It is isomorphous with microlite, with Niobium (Nb) content greater than Tantalum (Ta). It generally contains cerium, titanium, and sometimes Uranium 308, Yttrium, and Thorium. General formula: $A_2B_2O_6(O,OH,F)$ where A = Na,Ca,K,Fe^{+2},U^{+4},Sb^{+3},Pb,Th,Ce, or Y, and B = Nb, Ta, Ti, Sn, Fe^{+3}, or W. Pyrochlore occurs in pegmatites, and or carbonatites derived from alkalic igneous rocks and constitutes an ore of Niobium. Because pyrochlore contains 0.05% by weight of Uranium and Thorium it is regulated by the USNRC as "source material". Based on the radioactive nature of the ore and the slag resulting from the reduction of the ore, the Nuclear Regulatory Commission

(USNRC) personnel are interested in seeing the smelting to get a general idea of the process, emissions generated, handling of the materials, exposure of the personnel working at the facility, and potential exposure to the surrounding community. The USNRC regulates all facilities which handle materials greater than .05% by weight of thorium or uranium.

FINDINGS: I arrived on site at approximately 2130 and was met shortly afterward by Donna. We entered the facility and spoke to Knud, and Craig, who were going to accompany us on this inspection. USNRC personnel listed arrived and we proceeded to the conference room in the basement of the laboratory at the site and discussed the processing and handling of the ore, and materials associated with the process, from the delivery of the ore to the disposition of the slag at the site.

The ore is received by truck from Canada, and its origin is from several places, with 90% of the material coming from Cambria Mines approximately 200 miles north of Quebec. SMC receives a portion of its' ore from Germany, and Africa, but these ores are not as good a grade as the Canadian ore. The material is shipped labelled "LSA Radioactive"(low specific activity, a U.S. Department of Transportation designation) in covered trucks in "supersacks" and is in a powdered form when it leaves the mine. The large polyester burlap sacks hold 3,250 $\pm$ pounds of material and are labelled with barcode labels and computer inventoried upon arrival to the plant. There are 13 supersacks per load, and 8-12 loads are received per month based on production at the mine. Each load contains 41,557 pounds of material. The mine has guaranteed SMC 27 loads per quarter this year. The mine provides a chemical assay for each load of material and supplies SMC with three samples of the material for each lot. At the end of each calendar quarter SMC composites all samples and collects one sample from this composited material for analysis. The results are used for comparison to the mines analysis, and for the company records. The compositing is performed in a bucket and care is taken to insure that one sample per lot of material is analyzed. Some confusions remains regarding this aspect of the process, therefore, SMC was asked to submit a written description of the whole process.

The mine also provides material to other metallurgy facilities in Japan, the U.K., and Luxembourg. Knud informed us that Brazil is the worlds largest producer of Columbium ore and their production controls the market for the material.

The material is recieved in Department 203F (warehouse) where i t is labelled with barcode labels and computer inventoried. It is then moved to Department 111 where it is stored in one part of the building until it is processed in the other end of the same building. Shieldalloy claims this leaves little opportunity for the material to be spilled in other areas of the plant, creating a radioactive problem. The trucks entering the plant are screened with a scintillation detector, but not on a regular basis because Craig is not always aware of when the trucks arrive. The same hauler has delivered the material for at least the past two years in dedicated trailers, due to the radioactive nature of the material. Occasionally a wipe test is performed and is evaluated for gross alpha radiation, if the screening with the scintillation detector is above 200 dpm

FINDINGS CONT'D:
(disintegrations per minute). If a spill of the material occurs it is wiped upwith paper towels, or cleaned up with vacuums equipped with HEPA (high efficiency particulate absolute) filters. Yawar and Donna requested a letter detailing the handling, inventory, screening, and sampling of the raw material as it enters the plant.

The ore is made into ferro-columbium alloy using a fire down smelting process. In general this means that the ingredients are combined and the reaction is started in an open-hearth or open top furnace. The reactants consist of the pyrochlore ore (3 supersacks) and flux (4 bins) consisting of calcium carbonate, magnesium calcium carbonate (dolomite), steel scrap, 42% Al_2O_3 and aluminum wire scrap material. The flux to pyrochlor ratio is approximately 1.8 to 1. The reaction occurs in two phases, the first being exothermic and self-driving in nature. The reaction is started by "lighting" the material through the use of 3 carbon electrodes which pass 15,000 amps through the batch. The second part of the process is electrothermic in nature and this is when the material is heated through the use of the carbon electrodes. The firing of the furnace generally occurs at night to take advantage of the lower electric rates. Once the reaction is complete t he molten metal is poured from the furnace into three cast iron vats or "pots". The vats are set up one above the other in series and the metal is cascaded from the furnace and flows from vat to vat. The lighter slag material floats to the top and separates out with the ferro-columbium metal ending up in the first vat.

Three batches of the material are made per night. Each batch makes up approximately 1,600 pounds of metal containing $\pm$ 60% columbium. Fumes and dusts generated during the process are pulled up through a ceiling hood which leads to a baghouse adjacent to Department 111. The collector pulls about 325,000 SCFM (standard cubic feet per minute) and the baghouse filters material down to the five micron size at a greater than 99% efficiency. Due to the fact that the raw material added to the batch is greater than 5 microns, it is unlikely that fugitive emissions of radioactive material occur outside of the building or become airborne as a result of the process. Monitoring with a scintillation detector is performed during the process, but Craig did not detail what action would be taken if there were excursions of radiation over the action level.

Dust from the baghouse emits 70-100 pico-Curies/gram of Thorium. Slag generated during the process emits 600-1200 pico-Curies/gram of Thorium. The slag from the process contains approximately 0.5% columbium metal. The slag is taken to an area in the rear of the facility and dumped into segregated piles. The piles are separated based on their contents. The following are considered "source material" by the NRC with the noted exceptions:

Ferro-columbium standard slag
Columbium nickel high ratio slag
Ferro-columbium-columbite slag
lime dust pile #
Columbium nickel refractory
Ferro-columbium high ratio slag
Columbium nickel high purity slag*
Ferro-columbium high purity slag *

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FINDINGS CONT'D:
* Denotes material is non-radioactive source material
# Denotes that this material is from the baghouse

NOTE: As per CRAIG RIEMAN, AND KNUD KLAUSEN, the Columbite ore contained source material, therefore the FeCb-Columbite slag is NRC regulated!! (NRC requested additional information from SMC before they concur with this statement.)

At present SMC is looking for a buyer for the slag material for possible use or reprocessing but it is difficult to do because the receiving facility would need to be licensed to handle radioactive materials. Also, the magnesium content is too high for the material to be reused as a flux material by itself, similar to the ferro-vanadium (FeV) slag which is being sold as a product by SMC.

In the southeast corner of the rear yard at the facility Shieldalloy has a stockpile of approximately 100,000 tons of ferro-vanadium slag. This material is being sold off as a slag (flux) conditioner. The vanadium in the slag tends to make the slag more fluid and separable from the steel. Periodically, an outside contractor is hired to come in and crush the slag, and it is spread out and screened by a health physicist contractor for radioactive ferro-columbium slag which may have ended up in this material. If detected the radioactive material is manually picked out of the ferro-vanadium slag. In general the FeV slag has a background radioactivity of 5-15 pico-Curies/gram of Thorium.

OBSERVATIONS AND CONCLUSIONS: The smelting process at the facility appears to be a relatively clean operation, as far as fugitive emissions are concerned. Peripheral operations such as the loading of the furnace, mixing of the batch, removal of the slag from the pots, and its transport out to the rear yard probably have more of a potential for the spreading of the radioactive material. I anticipate that the personnel from the NRC will have a more detailed set of conclusions with regard to the possible emissions from the process and appropriate recommendations in response to their observations. Personnel working in this department were wearing personal radiation dosimeters and dust masks to protect themselves from the dust/radiation hazard. According to Yamar, there is not so much a hazard with regard to the level of radiation associated with the material, but with the volume of the material that is at the site.

Based on my observations I am making the following recommendations:

1. Fugitive emissions at the site from this process appear to be kept to a minimum, by the operation of the baghouse. If appropriate studies have not been performed at the site, it might be prudent to perform air monitoring for particulate emissions at the facility to make an assessment of the impacts at the facility and to the neighboring area. Parameters being analyzed for should include various constituents or byproducts which show up as contaminants or are trace constituents of ores or other materials associated with the variety of proceses at the site.

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OBSERVATIONS AND CONCLUSIONS (continued):

2. The following items were requested by NRC or NJDEPE personnel during the visit to the facility:

a. Health physicist data for the screening of the ferro-vanadium slag that is being marketed as product.

b. Institution of a log and record keeping process with regard to the screening of the ferro-vanadium material.

c. A description in writing of the procedures for handling of the ferro-columbium from the time of its' arrival on site, through the processing, and to the deposition of the slag in the yard to the rear of the facility. This description was to include any monitoring performed and record keeping involved with handling of the material. Procedures for dealing with radiation excursions outside of the limits set for health and safety monitoring should also be included.

INSPECTORS SIGNATURE

C: George Nicholas, GEOLOGIST
John Boyer, TECHNICAL COORDINATOR
Nancy Stanley, RADIATION
Yamar Faraz, USNRC

RPCE\PA\SMC21793.DLG

State of New Jersey
Department of Environmental Protection and Energy
Division of Environmental Safety, Health and Analytical Programs
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MAR - 3

Scott A. Weiner
Commissioner

Gerald P. Nicholls, Ph.D.
Director

February 26, 1993

M E M O R A N D U M

To: Fred Sickels, Research Scientist
Bureau of Environmental Radiation

From: Nancy Stanley, Radiation Physicist NMS
Bureau of Environmental Radiation

Subject: February 18, 1993 Shieldalloy Site Visit

On February 18, 1993, Nancy Stanley and Fred Sickels of this office visited the Shieldalloy facility in Newfield. The visit was coordinated with a visit by the NRC. The purpose of the visit was to familiarize ourselves with the site as well as to confirm previous on-site gamma surveys.

The attached site map indicates gamma exposure rate measurements made during the visit. Average background exposure rates for the area are between 6 and 8 uR/hour. Average exposure rates measured on the site, particularly in the source material storage yard, were between 50 and 100 uR/hour.

Measurements taken along the South Haul Road were on average 10-30 uR/hour above background, with visible pieces of slag contributing to the highest readings. Measurements were also obtained in the building where the smelting takes place (D-111) and were observed to be anywhere from 150-300 uR/hour. The highest reading was in close proximity to a recently poured (12 hours old) "pot" of ferro-columbium.

The lime pile, which had been covered with a thin layer of cement material, measured 100 uR/hour. Northern fenceline exposure rates near the ferro-columbium standard slag pile were on average 200 uR/hour. Exposure rates for the ferro-columbium standard slag were anywhere from 1.2-2.0 mR/hour, with the high-ratio ferro-columbium slag having similar readings. The ferro-columbium/columbite slag had an exposure rate of between 800 and 900 uR/hour. The ferro-vanadium slag, which SMC had been selling and shipping off-site, had measured exposure rates of 50-110 uR/hour.

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All measurements obtained confirmed previous surveys performed by DEPE. Time and weather did not permit us to survey any off-site areas, although based on the on-site data it is probably safe to assume that these readings would be similar to those taken in the past.

It is clear that Shieldalloy continues to be out of compliance with current exposure limits for NRC licensed activities, specifically in the vicinity of the ferrocolumbium slags.

If you have any questions pertaining to the visit, please let me know.

Attachment

c. R. Stern, Cheif, BER
D. Gaffigan, BFCM

GAMMA EXPOSURE RATES:

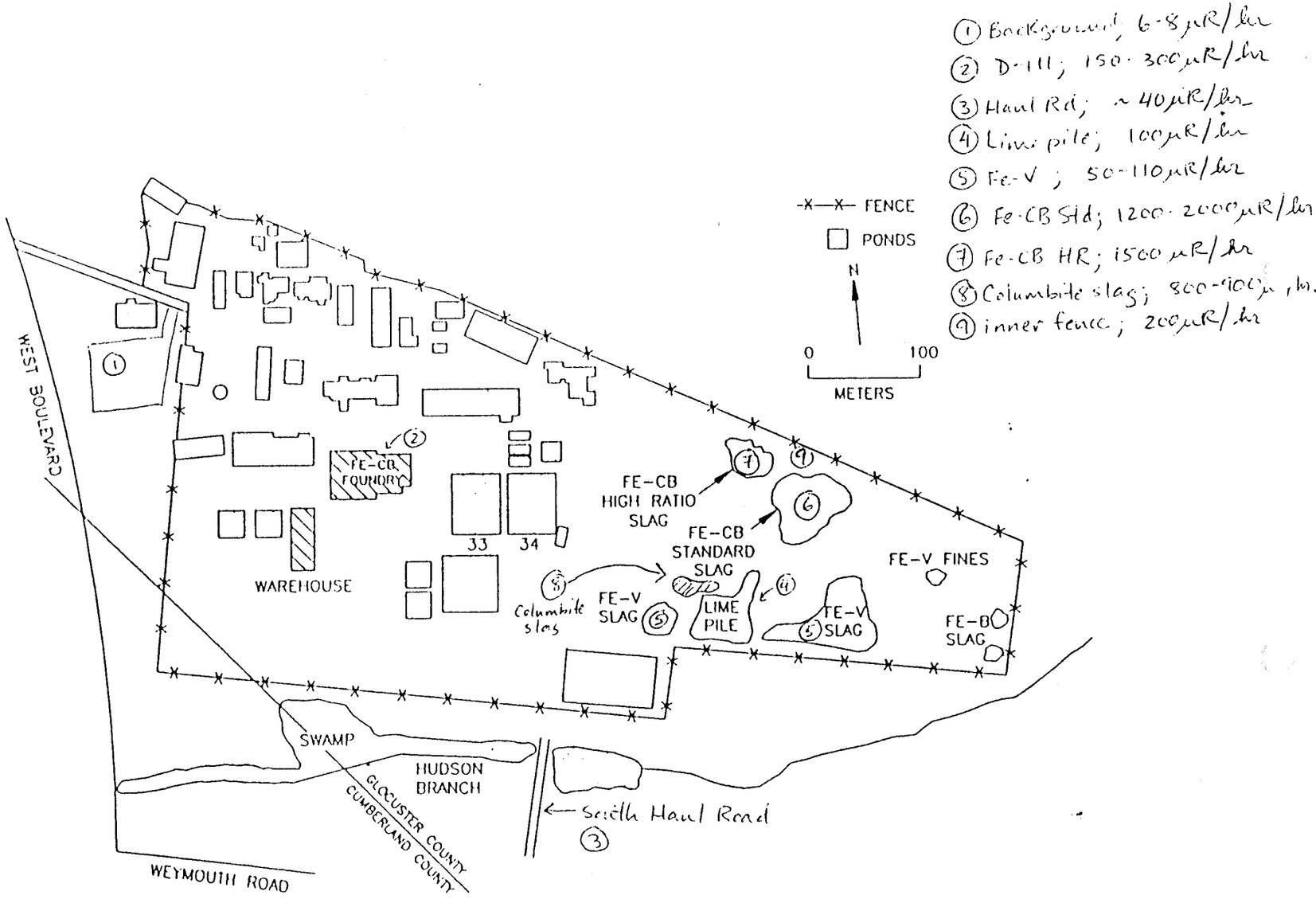

FIG.1: Layout of the Shieldalloy Plant in Newfield, New Jersey

Measurements obtained with Ludlum Model 19 Micro R Meter calibrated to Cs-137.